Impacts of Fire on Streams:

Watershed Changes, Assessment, and Mitigation

Peter M. Wohlgemuth

USDA Forest Service
Pacific Southwest Research Station

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Problem

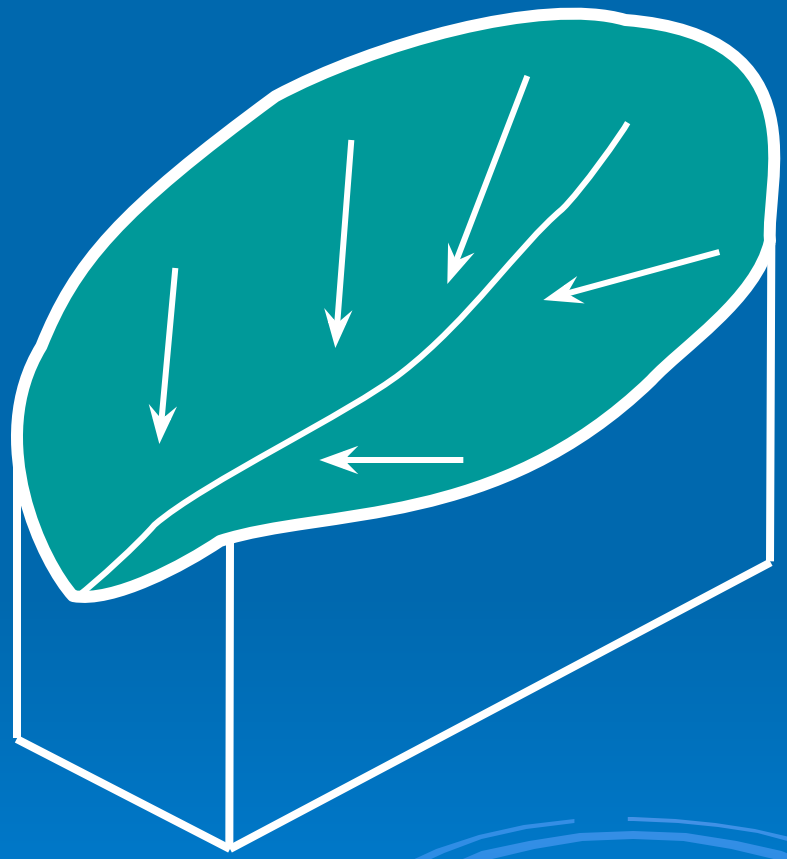
Wildfire renders the landscape susceptible to flooding and accelerated erosion and sedimentation, greatly affecting natural resources

Background

Runoff, erosion, and sedimentation are inevitable

Stripping of soil, sediment, and rock material from the highlands by the forces of gravity and running water and deposition in the lowlands

Fire is a natural part of most terrestrial ecosystems

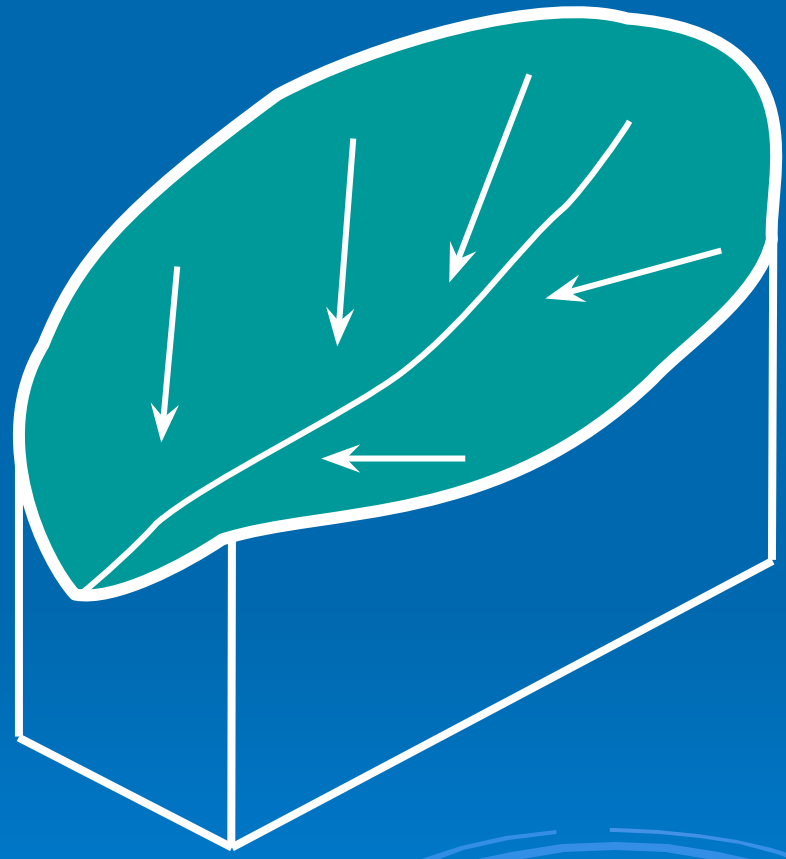


Background

Southern California has some of the highest erosion rates in the world

Hillslope erosion consists of both gravitational and hydrologic processes

Channel sediment loading and flushing is the dominant watershed transport mechanism



Unburned Conditions

Complete vegetation canopy

Spongy litter layer

Coarse-textured soils

Large infiltration capacity

Watershed Changes

Immediate flush of dry erosion

Loss of vegetation and litter

Changes in soil properties reduce infiltration

Extra delivery of water and sediment
from the hillsides to the stream channels

Watershed Changes

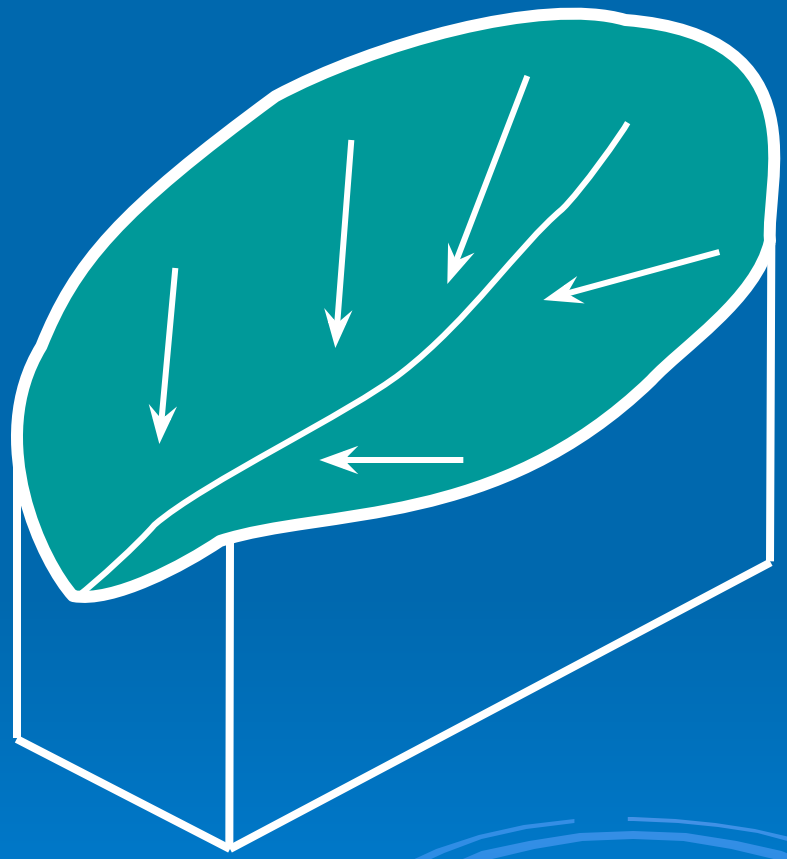
More rain reaches the ground (loss of canopy and litter layer)

Infiltration is greatly reduced

Overland flow greatly increases

Stream flow greatly increases

Post-fire erosion greatly increases

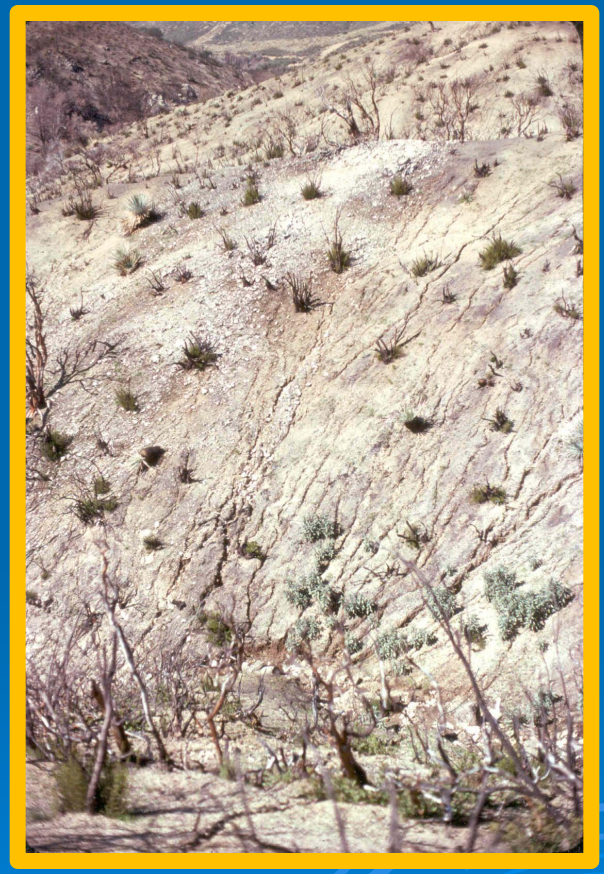


Watershed Changes

Dry ravel

Watershed Changes

Soil water repellency



Post-fire rilling

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Watershed Changes

Channel loading

Channel scour

Watershed Changes

Small Stream Erosion

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Watershed Changes

Downstream sedimentation

Watershed Changes

Post-fire Water Quality

Increase temperature
(remove shade)

Increase turbidity
(muddy water)

Change water chemistry
(ash, leachate, sediment)

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Assessment

Process

Identify values at risk

Identify the degree of burn

Visual inspection

Aerial imagery

Assessment

Factors Influencing Fire Impacts on Streams

Proximity

Topography

Burned area
Intervening area

Presence of engineering structures

Patterns and timing of post-fire rainfall

Mitigation

Intent of Emergency Mitigation

Cost-effective, landscape-level erosion control

Reduce and delay accelerated runoff and sediment yield until watersheds function normally again

Environmentally benign – including ground disturbance

Hillslope Treatments

Purpose is to control runoff and erosion on the hillsides

Treatments include:

Ground Covers	Mechanical Barriers	Chemical Sprays
Seeding	Contour logs	Wetting agents
Mulching	Fiber rolls	Soil flocculants
Erosion fabrics	Terraces/trenching	

Channel Treatments

Purpose is to trap sediment and control scour in the channels

Treatments include:

Check dams – straw, logs, rock
Bank stabilization – rock armoring, vegetation
Grade control structures
Debris basins

} **engineering structures that must be properly designed and constructed**

Stream Channel Mitigation

Bank stabilization

Stream Channel Mitigation

Straw bale check dams

Stream Channel Mitigation

Straw bale check dams

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Stream Channel Mitigation

Log check dams

Stream Channel Mitigation

Log check dams

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Stream Channel Mitigation

Stream mitigation treatments

Difficult to install

Labor intensive

Marginal benefits

Can increase the hazards

Summary / Conclusions

Erosion is inevitable and southern California experiences some of the highest erosion rates in the world

Fire further accelerates flooding and erosion on both hillslopes and in stream channels

Postfire flooding and erosion can negatively affect natural resources

Summary / Conclusions

Assessment of potential postfire impacts to streams includes factors of proximity, topography, the presence of engineering structures, and rainfall

Mitigation of postfire impacts to streams is costly and often ineffective

Postfire impacts to streams continues to be a major land management challenge

Questions?

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